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Books and Multimedia Reviews

Beyond the Moon: The Golden Age of Planetary Exploration 1971–1978

by R. S. Kraemer. Smithsonian Institution Press, Washington, D.C, USA, 2000, 270 pp., $34.95 paper (ISBN 1-56098-954-8).

I found this a fascinating book. I could not put it down. Robert Kraemer, the author, was Director of Planetary Programs at NASA headquarters throughout most of the 1970s and he describes 12 missions throughout that period that constituted what he calls the "Golden Age of Planetary Exploration". Much of his description is first hand, and very much from the point of view of a NASA administrator. It is a novel perspective that very few people could write. It is close to being an autobiography.

The book begins with a very brief history of the unmanned space program prior to the golden age and Kraemer taking up his headquarters position, and ends in an even briefer history of planetary exploration afterwards. The origins of the golden age lie in the excitement of the programs to land a man on the Moon; its demise lies in the problems of the development of the Space Shuttle and its cost overruns in a time of fiscal constraint. In between, Kraemer devotes a chapter to each of the missions, going fairly systematically through the origins of each mission, its management through funding, selection of the science experiments, its flight, and a brief summary of the science achievements. It is concise, easy and captivating writing, has the feeling of pride and accomplishment, and of being part of a unique adventure. There is *Mariner 9* in orbit around Mars in 1971, *Pioneer 10* and *11* and their excursions to the giant planets in 1972 and 1973, the *Helios* satellites in solar orbit (1974 and 1976), the *Mariner 10* flybys of Venus and Mercury (1973), the *Viking* landings on Mars in 1975, the *Voyager* flybys of the outer planets in 1977 and the Pioneer Venus missions of 1978. These were extraordinary missions with extraordinary scientific return. You can only be the first once, and this was the generation that first explored every planet of the solar system except Pluto.

This is not a book for students wanting a textbook on planetary science. Science is discussed very little, only enough to explain how the mission was justified to Congress and to round out the discussion of each mission. Reference is usually made to popular books describing the individual missions and their science achievements. Rather it is a book on mission management. We are taught to first establish the scientific caucus for a given mission, preferably through the National Research Council and its various advisory groups. Then develop a scientific rational to take the idea to Congress, and this will vary from mission to mission. Purely scientific justifications will not work, but justifications of broader social significance are needed. For example, the most difficult missions of the golden age to justify were the Pioneer Venus missions, but our understanding of global warming and the destruction of the ozone layer needed comparative planetology and what better comparison was there than the of the atmospheres of Mars (that had already been thoroughly studied by earlier missions), the Earth and Venus. Was Mars the past, Earth the present, and Venus the future? Then a management and engineering team had to be assembled—and I was surprised here to learn of the major contribution made to planetary exploration by NASA centers other than JPL—and a science team assembled, based mainly on who could contribute flight instruments. There were sometimes some painful decisions when scientists who were instrumental in getting missions started, did not have their instrument selected.

Kraemer's instructions on these points sometimes verge on sermons, but they are no less instructive for this. Some of his prejudices sound like the inevitable groaning of a NASA administrator, not as in tune with the engineers and scientists actually doing the constructing and flying of these complex missions as we would like. But Kraemer is as generous with his praise, where he thinks it is due, as he sometimes is with his scathing criticisms. His candor lends credibility to his assessment of individuals, but sometimes his criticism is very personal and unnecessary and perhaps says more about the author than his victim.

After more than a decade of inactivity, NASA's planetary program picked up again with some massive missions (Galileo and Cassini), and as funds again became limited as the nation attempted to balance its budget the "faster, better, cheaper" approach emerged—largely through Wesley Huntress' efforts—to take advantage of new technologies. Kraemer likes this development, and refers to a new "Goldin Age (pun intended)", and he cautions us not to overreact to the failures of late 1998. Most of all, the faster, better, cheaper approach has put scientists in the driver's seat of mission design, where they belong. Of all the missions in the golden age, the most scientific was the hardest to sell to Congress, so it is a tribute to the present NASA administration that programs like Discovery are such a success.

Beyond the Moon is a good book, written from a unique perspective, and immensely insightful. As I said, I could not put it down.

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